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09/665,911	09/20/2000	Yasuhiko Nomura	001221	5447

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EXAMINER

LANDAU, MATTHEW C

ART UNIT PAPER NUMBER

2815

DATE MAILED: 02/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/665,911

Applicant(s)

NOMURA ET AL.

Examiner

Matthew Landau

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03 December 2002.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)                      4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)                      5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_                      6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 5-7, and 9 are rejected under 35 U.S.C. 102(e) as being anticipated by Hata.

In regards to claim 1, Figure 1 of Hata discloses an active layer 4 composed of a nitride based semiconductor (AlGaN); a cladding layer 5 formed on said active layer, composed of a p-type nitride based semiconductor (AlGaN) (column 6, lines 63-66), and having a flat portion and a ridge portion formed on the flat portion; and a first current blocking layer 7 formed on said flat portion and on sidewalls of said ridge portion of said cladding layer and composed of a high-resistive nitride based semiconductor (AlGaN) containing impurities; wherein the cladding layer 5 is composed of  $\text{Al}_{0.1}\text{Ga}_{0.9}\text{N}$ ; and wherein the first current blocking layer 7 is composed of  $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}$ , which has a larger Al composition ratio than that of the cladding layer.

In regards to claims 5 and 6, Hata discloses the thickness of said first current blocking layer is 1 micron (column 6, lines 37-41).

In regards to claim 7, Hata discloses the thickness of the flat portion of said cladding layer 5 is 0.1 (column 6, lines 25-30).

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In regards to claim 9, Hata discloses the nitride based semiconductor contains gallium (column 5, lines 65-67).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Okazaki et al. (US Pat. 5,966,396), hereinafter referred to as Okazaki.

The difference between Hata and the claimed invention is the impurities containing at least one of zinc, beryllium, calcium, and carbon. Okazaki discloses doping the current blocking layer with zinc (see column 5, lines 60-61). It would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Hata by using zinc as the impurity ion. The ordinary artisan would have been motivated to modify Hata in the manner described above for at least the purpose of selecting an impurity ion with similar resistive properties.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Johnston, Jr. et al (US Pat. 4,888,624) hereinafter referred to as Johnston.

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The difference between Hata and the claimed invention is the first current blocking layer with a resistance value of not less than  $1.5 \Omega\text{-cm}$ . Johnston discloses a current blocking layer 20 having a resistivity of at least  $1 \times 10^6 \Omega\text{-cm}$  (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Hata to include a current blocking layer with a resistivity value greater than  $1.5 \Omega\text{-cm}$ . The ordinary artisan would have been motivated to modify Hata in the manner described above for at least the purpose of increasing the effectiveness of the current blocking layer.

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Adachi et al.

The difference between Hata and the claimed invention is a second current blocking layer formed on said first current blocking layer and composed of a nitride based semiconductor of a second conductivity type opposite to said first conductivity type. Figure 3 of Adachi et al. discloses a p-type cladding layer 5, a first current blocking layer 7, and an n-type second current blocking layer 8. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Hata by forming a second current blocking layer of a second conductivity type on the first current blocking layer. The ordinary artisan would have been motivated to modify Hata in the manner described above for the purpose of lowering the light confining effect while maintaining the carrier confining effect (see column 12, lines 50-55).

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7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Hiroyama et al.

The difference between Hata and the claimed invention is the flat portion of the cladding layer having a thickness not more than  $0.08\text{ }\mu\text{m}$ . Figure 1 of Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness  $t$  of flat portion 7a is selected to be not greater  $0.08\text{ }\mu\text{m}$  (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Hata by decreasing the thickness of the flat portion to a value not more than  $0.08\text{ }\mu\text{m}$ . The ordinary artisan would have been motivated to modify Hata in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

8. Claims 10, 11, 15-17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Hirata.

In regards to claim 10, Figure 1 of Hata discloses an active layer 4 composed of a nitride based semiconductor ( $\text{AlGaN}$ ); a cladding layer 5 formed on said active layer, composed of a p-type nitride based semiconductor ( $\text{AlGaN}$ ) (column 6, lines 63-66), and having a flat portion and a ridge portion formed on the flat portion; and a first current blocking layer 7 formed on said flat portion and on sidewalls of said ridge portion, wherein the cladding layer 5 is composed of  $\text{Al}_{0.1}\text{Ga}_{0.9}\text{N}$ ; and wherein the first current blocking layer 7 is composed of  $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}$ , which has a larger Al composition ratio than that of the cladding layer. The difference between Hata and the claimed invention is the cladding layer having a recess on said flat portion along both

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sidewalls of said ridge portion, wherein the current blocking layer is embedded in said recess.

Figure 2A of Hirata discloses a semiconductor light emitting device comprising a cladding layer 4 having a flat portion (4b,4c) and a ridge portion 4a, said cladding layer having a recess 4b and a current blocking layer 8 is embedded in said recess. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Hata by including the recess portion of Hirata. The ordinary artisan would have been motivated to modify Hata in the manner described above for the purpose of improving the yield of the light emitting device (column 7, lines 6-22).

In regards to claim 11, Hata discloses the first current blocking layer 7 is composed of a high-resistive nitride based semiconductor (AlGaN) containing impurities (column 6, lines 37-41).

In regards to claims 15 and 16, Hata discloses the thickness of said first current blocking layer is 1 micron (column 6, lines 37-41).

In regards to claim 17, Hata discloses the thickness of the flat portion of said cladding layer 5 is 0.1 (column 6, lines 25-30).

In regards to claim 19, Hata discloses the nitride based semiconductor contains gallium (column 5, lines 65-67).

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Hirata as applied to claim 10 above, and further in view of Okazaki.

A further difference between Hata and the claimed invention is the impurities containing at least one of zinc, beryllium, calcium, and carbon. Okazaki discloses doping the current

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blocking layer with zinc (see column 5, lines 60-61). It would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hata by using zinc as the impurity ion. The ordinary artisan would have been motivated to modify Hata in the manner described above for at least the purpose of selecting an impurity ion with similar resistive properties.

10. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Hirata as applied to claim 10 above, and further in view of Johnston.

A further difference between Hata and the claimed invention is the first current blocking layer with a resistance value of not less than  $1.5 \Omega\text{-cm}$ . Johnston discloses a current blocking layer 20 having a resistivity of at least  $1 \times 10^6 \Omega\text{-cm}$  (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hata to include a current blocking layer with a resistivity value greater than  $1.5 \Omega\text{-cm}$ . The ordinary artisan would have been motivated to modify Hata in the manner described above for at least the purpose of increasing the effectiveness of the current blocking layer.

11. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Hirata as applied to claim 10 above, and further in view of Adachi et al.

A further difference between Hata and the claimed invention is a second current blocking layer formed on said first current blocking layer and composed of a nitride based semiconductor of a second conductivity type opposite to said first conductivity type. Figure 3 of Adachi et al.



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discloses a p-type cladding layer 5, a first current blocking layer 7, and an n-type second current blocking layer 8. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hata by forming a second current blocking layer of a second conductivity type on the first current blocking layer. The ordinary artisan would have been motivated to modify Hata in the manner described above for the purpose of lowering the light confining effect while maintaining the carrier confining effect (see column 12, lines 50-55).

12. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hata in view of Hirata as applied to claim 17 above, and further in view of Hiroyama et al.

A further difference between Hata and the claimed invention is the flat portion of the cladding layer having a thickness not more than  $0.08\text{ }\mu\text{m}$ . Figure 1 of Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness  $t$  of flat portion 7a is selected to be not greater  $0.08\text{ }\mu\text{m}$  (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hata by decreasing the thickness of the flat portion to a value not more than  $0.08\text{ }\mu\text{m}$ . The ordinary artisan would have been motivated to modify Hata in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

13.

***Response to Arguments***

14. Applicant's arguments with respect to claims 1-19 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (703) 305-4396.

The examiner can normally be reached on 8:00 AM-4: 30 PM.  
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization

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where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Matthew C. Landau

Examiner

January 28, 2003

A handwritten signature in black ink, appearing to read 'Eddie Lee', with a large, sweeping initial 'E'.

**EDDIE LEE**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2800**